

# Components of a DNC System

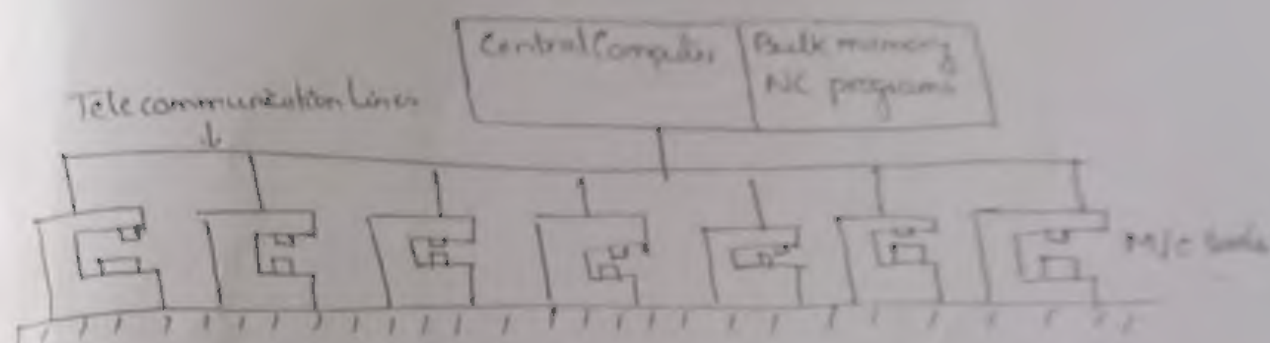
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(1) Central Computer

a) Bulk memory, which stores the NC part programs

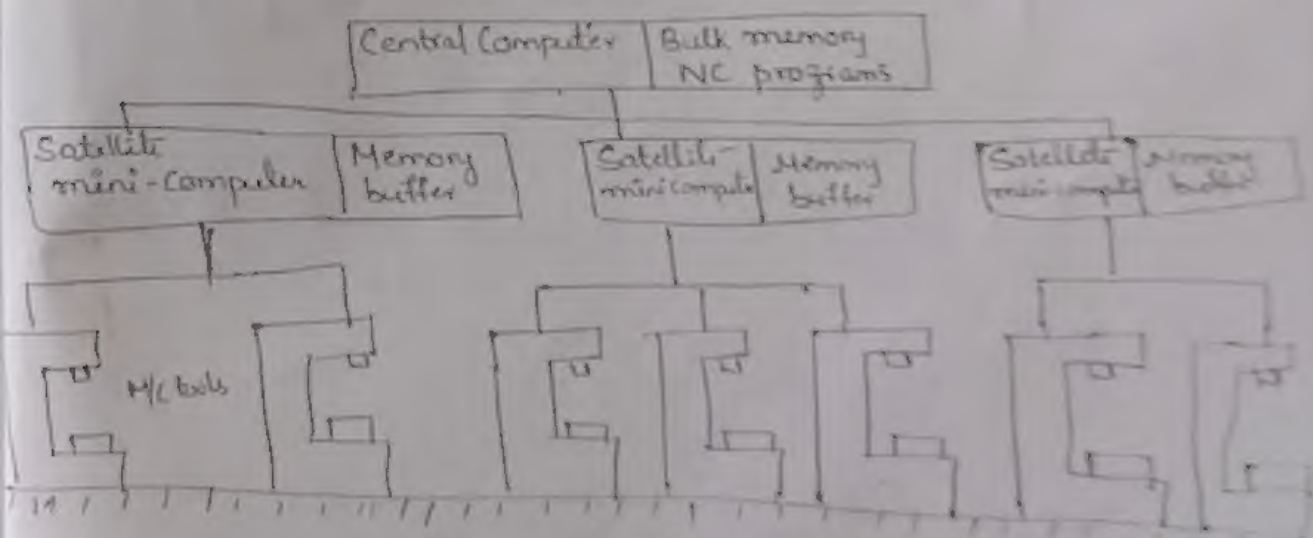
(2) Telecommunication lines

(4) Machine tools



The computer calls the part program instructions from bulk storage and sends them to the individual machines as the need arises. It also receives data back from the machines.

Similarly, the computer must always be ready to receive information from the machines and to respond accordingly.



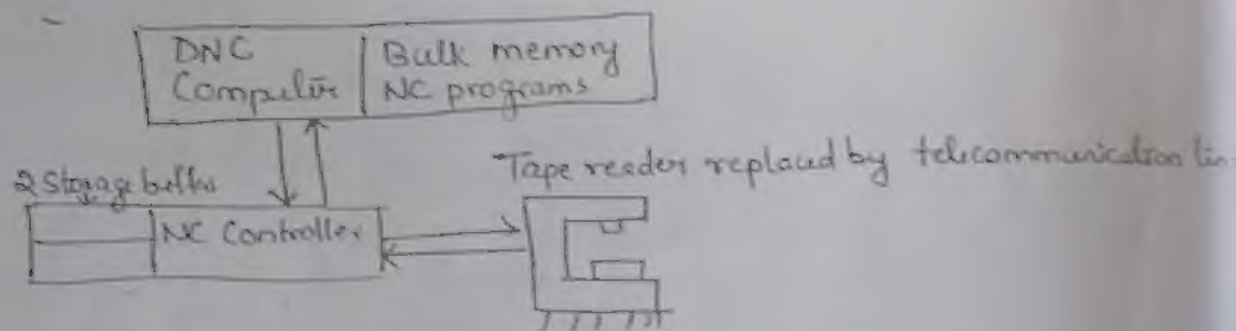
DNC with satellite mini-computer

- Sometimes, it is necessary to use Satellite Computers. These satellites are mini-computers and they take some of the burden off the central computer.
- Each satellite controls several machines. Groups of part program instructions are received from the Central Computer and stored in buffers. They are then dispensed to the individual machines as required.
- Feedback data from the machines are also stored in Satellite's buffer before being collected at the Central Computer.

### Two types of DNC

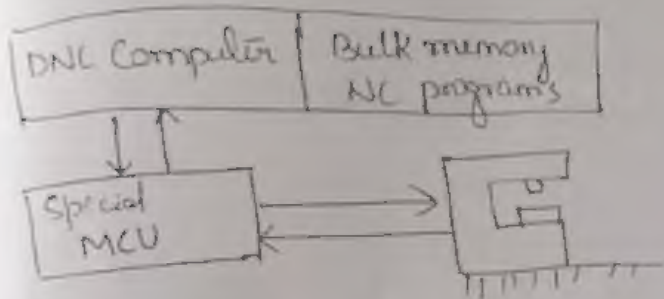
- (1) BEHIND-THE-TAPE-READER (BTR) System
- (2) SPECIALIZED MACHINE CONTROL UNIT

#### (1) BTR System:-



- The connection <sup>with</sup> the computer is made bet<sup>n</sup> the tape reader and the Controller unit - behind the tape reader.
- The Controller unit uses two temporary buffers to receive blocks of instructions from the DNC Computer and convert them into m/c actions.
- While one buffer is receiving a block of data, the other providing control instructions to the m/c tool.

## 2) Special NC Control Unit



### DNC with special MCU

- The other strategy in DNC is to eliminate the regular NC controller and replace it with a special MCU.
  - This special MCU is a device that is specifically designed to facilitate communication between the NC tool and the computer.
  - The special MCU configuration achieves a superior balance between accuracy of the interpolation and fast metal removal rates than is generally possible with the BTR system.
  - The special MCU is soft-wired, while the conventional NC controller is hard-wired.
- The advantage of soft-wiring is its flexibility. Its control functions can be altered with relative ease to make improvements. It is much more difficult to make changes in the regular NC controller because rewiring is required.
- BTR cost is less, since only minor changes are needed in the conventional NC system to bring DNC into the shop.
  - BTR systems don't require the replacement of the conventional control unit by a special MCU.



## Functions of DNC.

- (1) NC without punched tape
- (2) NC post program storage
- (3) Data collection, processing & reporting
- (4) Communications

### NC without punched tape :-

- Several of the problems with conventional NC are related to the use of punched tape (unreliable tape reader, paper tape, difficulties in making corrections & changes in the program contained on punched tape, etc)
- There is also the expense associated with the equipment that produces the punched tape.  
(So it is eliminated)

### (2) NC post program storage :-

- A second important fun<sup>n</sup> of the DNC system is concerned with storing the part programs.
- First, the programs must be available for downloading to the NC machine tools.
- Second, the subsystem must allow for new programs to be entered, old programs to be deleted and existing programs to be edited as the need arises.
- Third, DNC software must accomplish the post processing function.
- Fourth, the storage subsystem must be structured to perform data processing & management functions such as file security, display of programs, manipulation of data etc.

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DNC program storage subsystem consists of an active storage & a secondary storage.

Active storage used to store NC programs which are frequently used. The active storage can be readily accessed by the DNC computer to drive an NC m/c in production.

Secondary storage would be used for NC programs which are not frequently used.

Ex:- Magnetic tape, floppy disks, punched tape.

### 3) Data collection, processing & reporting

DNC involves the transfer of data from the m/c tools back to the central computer. DNC involves a two-way transfer of data.

The basic purpose is to monitor production.

### Communications :-

- A communications network is required to accomplish the previous 3 functions of DNC.
- Communication among the various subsystem is a function that is central to the operation of any DNC system.
- The essential communication links in DNC are built on the following components of the system.

Central computer & m/c tools

Central computer & NC part programmer terminals

Central computer & bulk memory, which stores the NC programs.



## Advantages of DNC

### (1) Elimination of punched tape & tape readers :-

DNC eliminates the punched tape & tape readers from the system, hand-wired control unit. It also eliminates an operator replaced by a special m/c control unit (designed to be compatible with DNC operation).

### (2) Greater computational capability & flexibility :-

- The DNC system performs the computational & data processing functions more effectively than traditional.
- Because these functions are implemented with software rather than hard-wired devices, there exists the flexibility to alter and improve the method.

### (3) Convenient storage of NC part programs in computer files :- (punched tapes used in conventional NC)

### (4) Reporting of shop performance :-

It collects, processes and reports about the production performance data from the NC machines.

### (5) Establishes the framework for the evolution of future computer-automated factory.

## Combined DNC/CNC Systems

- The combination of DNC & CNC provides the opportunity to add new capabilities & refine existing capabilities in these computerized manufacturing systems.
- The combination of CNC & DNC  $\rightarrow$  resulted in elimination of the use of punched tape as the input media for CNC machines.

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The DNC computer downloads the program directly to the CNC computer memory.

The second advantage of combining DNC & Tool is redundancy. If the central DNC computer fails, this will not necessarily cause the individual machines in the system to be down. It is possible to provide the necessary backup to permit the CNC machines to operate on a stand-alone basis.

- \* This backup capability consists of two elements. The first is a file of punched tapes which duplicate the programs contained in the DNC computer files.
- \* The second is that each CNC m/c must be equipped with a tape reader for the purpose of entering the program from the punched tape.

The third improvement that develops from combined DNC/CNC systems is improved communication between the control computer and the shop floor.

It is easier for computers to communicate with other computers than with hard-wired devices.

## Adaptive Control Machining Systems

For a machining operation, the term 'adaptive control' denotes a control system that measures certain output process variables and uses these to control speed/feed.

Some of the process variables that have been used in adaptive control machining systems include spindle deflection or force, torque, cutting temp, vibration amplitude.